Chapter 4

Results of Screening-Level Hazard Analyses

The screening-level hazard analysis of Point Source Inventory data from the 1993 Toxic Release Inventory (TRI) and the 1994 Permit Compliance System (PCS) can be used to evaluate the release of sediment contaminants and to identify the chemical classes, watersheds, and industrial categories that may be associated with potential sediment quality problems arising from point sources. The analysis does not necessarily indicate where contaminated sediment problems have occurred or who is responsible. Further information to screen watersheds can be obtained when the release data are compared to the Site Inventory data evaluation.

This chapter describes how the Point Source Inventory data were prepared for the hazard analysis and highlights the results by chemical, watershed, and industrial category. Tables and figures of summary information are presented within the body of the text. Longer tables that contain more detailed information are presented in Appendices B and C. Appendix B contains a listing of watersheds (defined by 8-digit U.S. Geological Survey (USGS) cataloging units) grouped by specific ranges of HAZREL scores. These groups are referred to as priority groups in this report. Appendix C contains detailed information on chemicals associated with the industrial categories evaluated in this analysis.

Preparation of Data for Hazard Analysis

The first step in conducting the screening-level hazard analysis was to qualitatively examine the Point Source Inventory data for validity and prepare the data for analysis. Of the original 233 potential sediment contaminants analyzed as part of the Site Inventory, 122 were excluded from the hazard analysis because SHS could not be calculated or no data were available for analysis. Table A1 in Appendix A contains a complete list of the remaining 111 sediment contaminants participating in the hazard analysis.

Although the PCS and TRI data were not systematically checked for errors when the inventory was developed, an attempt was made to eliminate highly suspect records from the hazard analysis. Several loading records from PCS were excluded from the hazard analysis because they were highly suspect and would bias the results. For this analysis, EPA defined a highly suspect record as the release of any chemical in excess of one-half million pounds per year. While feasible at large municipal treatment works such as Chicago Main or Blue Plains in Washington, DC, experience in examining PCS records indicates that these extremely large surface water releases can be traced back to incorrectly reported concentration or flow measurements. Because incorrect flow measurements would have an impact on all loadings reported for that facility, all data for 21 facilities from PCS were removed from further analysis. Based on examining monitoring data reported for dioxin in PCS, all

dioxin data were also excluded from the analysis. Many dioxin records were listed as below detection, and thus treated as zero discharge. EPA had little confidence in the remaining detectable levels because of problems with measurement units and other concerns. No facilities from TRI were removed from the analysis.

More than 25,500 individual records of direct or indirect pollutant releases to surface water from point sources were examined in the screening-level hazard analysis for their potential to contribute to sediment contamination. Releases of 111 different chemicals including divalent metals (i.e., cadmium, copper, lead, nickel, and zinc); mercury; other metals; polynuclear aromatic hydrocarbons (PAHs); pesticides; polychlorinated biphenyls (PCBs); and other organic compounds were analyzed. The 1993 TRI data have release records for 60 of these chemicals, and the 1994 PCS data have release records for 108 of these chemicals.

PCS records show that direct releases of sediment contaminants from 4,869 facilities totaled nearly 19 million lb/yr in 1994. Based on 1993 TRI data, direct releases and transfers to POTWs (multiplied by 0.25 to account for removal during treatment) from 3,432 manufacturing facilities totaled 7.3 million lb/yr. Facilities with chemical release records in PCS and/or TRI were located in all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands. Over 1,000 individual watersheds, as defined by USGS 8-digit cataloging units, receive loads of potential sediment contaminants as reported by PCS and TRI. This corresponds to approximately one-half of all watersheds in the United States. Individual facilities are placed into 31 distinct industrial categories. These categories represent a broad range of activities (e.g., POTWs, chemical manufacturers, textile mills, coal mines).

Analysis by Chemical

Table 4-1 presents the annual release, HAZREL, and HAZREL score for each of the 60 chemicals included in the hazard analysis for TRI data. The SHS and the number of facilities reporting surface water releases or POTW transfers for each chemical are also included in Table 4-1. Based on TRI data, xylene, nickel, and copper have the largest aggregate HAZREL scores. Together with the next seven chemicals listed in Table 4-1 (lead, toluene, phenol, chromium, 1,1,1-trichloroethane, trichloromethane, and benzene), all with HAZREL scores greater than 80, the top 10 chemicals represent more than 69 percent of the aggregate HAZREL score for data from TRI.

Table 4-2 shows the corresponding information for the 108 chemicals included in the hazard analysis for PCS data. Based on PCS data, zinc, copper, and nickel have the largest aggregate HAZREL scores. Together with the next 10 chemicals listed in Table 4-2 (cadmium, silver, mercury, lead, chromium, arsenic, PCBs, benzo(a)pyrene, antimony, and tetrachloroethene), all with HAZREL scores greater than 80, the top 13 represent more than 86 percent of the aggregate HAZREL score for data from PCS.

Several chemicals have large aggregate national raw loads and are released from a large number of facilities (i.e., zinc and copper), whereas other chemicals (e.g., chlordane) appear to represent a few isolated releases. Tables 4-1 and 4-2 also present the distribution of records by HAZREL score. The HAZREL score distribution is skewed to the right for most chemicals. That is, most records indicate a low HAZREL score (i.e., less than 3); substantially fewer records have large HAZREL scores. This assessment transforms the

Table 4-1. Analysis of TRI Data by Chemical (Sorted by Descending HAZREL Score)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Other	Xylenes	429	1.6E-01	216,429	3.5E+04	179	86	129	24	11	-	460
Divalent Metal	Nickel	673	9.7E-02	62,936	6.1E+03	354	233	76	10	-	-	415
Divalent Metal	Copper	1,092	1.9E-02	80,855	1.5E+03	730	339	22	1	-	-	386
Divalent Metal	Lead	317	2.3E-02	31,596	7.3E+02	218	91	7	1	-	-	108
Other	Toluene	513	2.5E-03	375,394	9.4E+02	437	56	19	1	-	-	97
Other	Phenol	313	1.1E-03	1,081,204	1.2E+03	243	46	22	2	-	-	96
Metal	Chromium	578	1.4E-02	43,481	6.1E+02	492	76	10	-	-	-	96
Other	Trichloroethane, 1,1,1-	209	1.3E-01	26,026	3.4E+03	138	53	13	5	-	-	94
Other	Trichloromethane	141	1.2E-03	602,141	7.2E+02	69	55	16	1	-	-	90
Other	Benzene	192	1.3E-02	95,948	1.2E+03	134	37	18	3	-	-	82
Other	Tetrachloroethene	78	6.5E-02	37,904	2.5E+03	43	17	13	5	-	-	58
Divalent Metal	Zinc	129	1.2E-02	92,386	1.1E+03	88	34	5	2	-	-	50
PAH	Naphthalene	121	1.4E-02	37,211	5.2E+02	83	30	7	1	-	-	47
Other	Pentachlorophenol	23	7.9E-01	2,824	2.2E+03	3	9	3	8	-	-	39
Other	Biphenyl	64	2.6E-03	203,381	5.3E+02	38	16	8	2	-	-	38
Other	Acrylonitrile	47	4.7E-02	53,565	2.5E+03	26	9	9	2	1	-	37
Other	Trichloroethene	120	1.7E-02	16,662	2.8E+02	91	25	3	1	-	-	34
Other	Xylene, o-	28	1.5E-01	6,743	1.0E+03	9	6	11	2	-	-	34
Other	Diethyl phthalate	33	7.1E-02	75,866	5.4E+03	9	20	1	2	1	-	32
Metal	Silver	30	1.4E+00	802	1.1E+03	6	18	4	2	-	-	32
Mercury	Mercury	14	7.0E+00	271	1.9E+03	-	3	5	6	-	-	31
Other	Bis(2-ethylhexyl) phthalate	58	2.7E-02	7,843	2.1E+02	34	18	6	-	-	-	30
Other	Dichloroethane, 1,2-	35	1.8E-02	10,281	1.9E+02	14	14	7	-	-	-	28
Divalent Metal	Cadmium	29	5.2E-01	951	4.9E+02	13	7	7	2	-	-	27
Metal	Antimony	52	2.5E-02	17,873	4.5E+02	35	10	5	2	-	-	26
Other	Tetrachloromethane	26	1.3E-01	1,872	2.4E+02	10	9	7	-	-	-	23

Table 4-1. (Continued)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Other	Dichlorobenzene, 1,2-	16	8.6E-02	9,872	8.5E+02	4	4	6	2	-	-	22
PAH	Anthracene	18	5.5E-01	741	4.1E+02	4	7	6	1	-	-	22
Other	Xylene, m-	13	1.6E-01	11,140	1.8E+03	2	4	5	1	1	-	21
Other	Xylene, p-	13	1.6E-01	8,679	1.4E+03	4	2	6	-	1	-	18
Other	Trichlorobenzene, 1,2,4-	28	4.2E-03	43,813	1.8E+02	16	7	5	-	-	-	17
Other	Cresols	37	1.4E-02	14,512	2.0E+02	24	10	2	1	-	-	17
Other	Dichloropropane, 1,2-	8	2.2E-01	4,812	1.1E+03	-	2	4	2	-	-	16
Metal	Arsenic	40	7.1E-02	1,731	1.2E+02	27	10	3	-	-	-	16
Other	Trichloroethane, 1,1,2-	12	2.0E-01	2,430	4.9E+02	3	4	4	1	-	-	15
Other	Chlorobenzene	34	2.0E-02	5,651	1.1E+02	21	11	2	-	-	-	15
Other	Dimethyl phthalate	18	1.7E-02	33,101	5.6E+02	8	7	1	2	-	-	15
Other	Hexachlorobenzene	5	3.4E+00	539	1.8E+03	-	-	1	4	-	-	14
Other	Dichloromethane	184	2.4E-04	273,711	6.6E+01	173	11	-	-	-	-	11
Other	Tetrachloroethane, 1,1,2,2-	7	3.0E-01	2,969	8.9E+02	3	1	1	2	-	-	9
Other	Dichlorobenzene, 1,4-	7	8.3E-02	2,173	1.8E+02	2	2	3	-	-	-	8
Other	Hexachlorobutadiene	4	1.9E-01	1,204	2.3E+02	1	1	1	1	-	-	6
Pesticide	Chlordane	1	5.0E+02	28	1.4E+04	-	-	-	-	-	1	5
Pesticide	BHC, gamma\Lindane	2	2.1E+02	2	3.2E+02	-	-	1	1	-	-	5
Other	Dimethylphenol, 2,4-	6	2.0E-02	1,509	3.0E+01	2	3	1	-	-	-	5
Other	Cresol, m-	8	1.4E-02	3,040	4.3E+01	4	3	1	-	-	-	5
PCB	Polychlorinated biphenyls	1	2.9E+02	66	1.9E+04	-	-	-	-	-	1	5
Other	Di-n-butyl phthalate	28	5.5E-03	5,830	3.2E+01	25	2	1	-	-	-	4
Pesticide	Methoxychlor	1	5.8E+01	5	2.9E+02	-	-	-	1	-	-	3
Other	Hexachloroethane	2	5.9E-02	291	1.7E+01	1	-	1	-	-	-	2
Pesticide	Heptachlor	1	5.8E+00	13	7.3E+01	-	-	1	-	-	-	2
Other	Cresol, o-	6	3.5E-03	10,394	3.6E+01	5	-	1	-	-	-	2

Table 4-1. (Continued)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Other	Cresol, p-	9	6.5E-05	217,420	1.4E+01	8	-	1	-	-	-	2
Other	Dichlorobenzene, 1,3-	4	1.9E-02	523	9.9E+00	2	2	-	-	-	-	2
Other	Butyl benzyl phthalate	45	1.5E-03	4,950	7.4E+00	44	1	-	-	-	-	1
Other	Ethylbenzene	220	2.8E-04	29,600	8.3E+00	219	1	-	-	-	-	1
Other	Acetone	469	3.5E-06	3,064,869	1.1E+01	469	-	-	-	-	-	0
Other	Trichlorofluoromethane	9	2.8E-05	1,700	4.8E-02	9	-	-	-	-	-	0
Other	Methyl ethyl ketone	254	5.4E-07	386,356	2.1E-01	254	-	-	-	-	-	0
Other	Dibenzofuran	5	7.3E-03	136	9.9E-01	5	-	-	-	-	-	0

Table 4-2. Analysis of PCS Data by Chemical (Sorted by Descending HAZREL Score)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Divalent Metal	Zinc	3,018	1.2E-02	10,194,441	1.2E+05	1,478	946	449	112	33	-	2,312
Divalent Metal	Copper	2,765	1.9E-02	3,123,697	5.9E+04	1,633	780	283	57	12	-	1,565
Divalent Metal	Nickel	1,320	9.7E-02	1,014,946	9.8E+04	463	431	320	92	13	1	1,404
Divalent Metal	Cadmium	1,153	5.2E-01	188,980	9.8E+04	546	363	188	47	8	1	917
Metal	Silver	675	1.4E+00	535,437	7.5E+05	179	197	214	63	20	2	904
Mercury	Mercury	749	7.0E+00	28,592	2.0E+05	269	233	172	62	9	4	819
Divalent Metal	Lead	2,018	2.3E-02	654,901	1.5E+04	1,491	376	128	21	2	-	703
Metal	Chromium	1,456	1.4E-02	525,942	7.4E+03	1,061	301	86	7	1	-	498
Metal	Arsenic	498	7.1E-02	504,168	3.6E+04	265	138	72	20	2	1	355
PCB	Polychlorinated biphenyls	62	2.9E+02	1,611	4.7E+05	12	6	13	14	13	4	146
PAH	Benzo(a)pyrene	54	4.2E+01	476	2.0E+04	3	13	10	22	6	-	123
Metal	Antimony	138	2.5E-02	255,532	6.4E+03	78	37	18	4	1	-	89
Other	Tetrachloroethene	163	6.5E-02	117,021	7.6E+03	101	41	17	3	1	-	88
Other	Bis(2-ethylhexyl) phthalate	180	2.7E-02	41,963	1.1E+03	124	39	14	3	-	-	76
Other	Xylenes	277	1.6E-01	18,816	3.0E+03	228	36	8	4	1	-	68
Pesticide	BHC, gamma- \ Lindane	32	2.1E+02	140	2.9E+04	6	4	10	8	3	1	65
PAH	Benzo(a)anthracene	35	1.1E+01	347	3.8E+03	8	6	8	13	-	-	61
PAH	Benzo(b)fluoranthene	34	4.8E+00	423	2.0E+03	5	9	13	7	-	-	56
Other	Hexachlorobenzene	40	3.4E+00	327	1.1E+03	12	12	12	4	-	-	48
Other	Trichloromethane	323	1.2E-03	1,003,597	1.2E+03	290	24	6	3	-	-	45
Pesticide	Chlordane	18	5.0E+02	57	2.9E+04	2	2	5	5	3	1	44
PAH	Benzo(k)fluoranthene	32	4.7E+00	283	1.3E+03	8	9	10	5	-	-	44
Other	Trichloroethane, 1,1,1-	144	1.3E-01	12,076	1.6E+03	111	25	7	-	1	-	43
PAH	Pyrene	40	1.4E+00	450	6.3E+02	14	12	13	1	-	-	41
Other	Tetrachloromethane	58	1.3E-01	190,869	2.5E+04	33	19	3	1	1	1	37
Other	Trichloroethene	204	1.7E-02	33,202	5.6E+02	180	15	7	2	-	-	35

Table 4-2. (Continued)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
PAH	Dibenzo(a,h)anthracene	11	2.2E+02	58	1.3E+04	-	-	3	4	4	-	34
Other	Benzene	458	1.3E-02	88,624	1.2E+03	437	10	9	2	-	-	34
Pesticide	DDT	14	2.1E+02	391	8.2E+04	3	1	5	3	-	2	30
Other	Dichloropropane, 1,2-	40	2.2E-01	3,544	7.8E+02	18	16	4	2	-	-	30
Other	Toluene	430	2.5E-03	155,171	3.9E+02	410	11	8	1	-	-	30
Pesticide	Toxaphene	15	4.6E+01	96	4.4E+03	2	3	5	4	1	-	29
Pesticide	Dieldrin	12	1.6E+03	377	6.0E+05	1	3	2	4	1	1	28
PAH	Chrysene	33	1.0E+00	296	3.0E+02	14	10	9	-	-	-	28
Other	Trichloroethane, 1,1,2-	50	2.0E-01	698	1.4E+02	28	17	5	-	-	-	27
Other	Pentachlorophenol	32	7.9E-01	1,395	1.1E+03	14	10	7	1	-	-	27
PAH	Anthracene	32	5.5E-01	339	1.9E+02	13	11	8	-	-	-	27
PCB	PCB-1242	16	2.9E+02	5	1.6E+03	2	6	3	5	-	-	27
PCB	PCB-1248	14	2.9E+02	11	3.1E+03	2	4	4	3	1	-	25
PAH	Indeno(1,2,3-cd)pyrene	12	1.3E+01	61	8.0E+02	2	3	3	4	-	-	21
PCB	PCB-1016	12	2.9E+02	3	8.3E+02	2	3	3	4	-	-	21
PAH	Phenanthrene	45	1.5E-01	26,362	4.0E+03	29	14	1	-	1	-	20
Other	Dichloroethane, 1,2-	89	1.8E-02	8,700	1.6E+02	73	12	4	-	-	-	20
PCB	PCB-1254	13	2.9E+02	3	7.7E+02	3	3	4	3	-	-	20
Other	Dichlorobenzene, 1,2-	44	8.6E-02	1,462	1.3E+02	29	11	4	-	-	-	19
PCB	PCB-1260	12	2.9E+02	2	7.2E+02	2	4	3	3	-	-	19
Pesticide	DDD	11	2.6E+02	70	1.8E+04	4	1	3	2	-	1	18
Other	Dichlorobenzene, 1,4-	50	8.3E-02	1,492	1.2E+02	34	14	2	-	-	-	18
PCB	PCB-1221	11	2.9E+02	3	9.6E+02	2	3	3	3	-	-	18
PCB	PCB-1232	11	2.9E+02	2	7.2E+02	2	3	3	3	-	-	18
Pesticide	DDE	11	3.4E+02	1,145	3.9E+05	4	1	4	1	-	1	17
Other	Hexachlorobutadiene	35	1.9E-01	455	8.6E+01	20	14	1	-	-	-	16

Table 4-2. (Continued)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Pesticide	Aldrin	14	4.5E+02	2	7.3E+02	5	4	4	1	-	-	15
Other	Acrylonitrile	41	4.7E-02	1,784	8.4E+01	29	10	2	-	-	-	14
Other	Diethyl phthalate	43	7.1E-02	4,377	3.1E+02	33	8	1	1	-	-	13
PAH	Fluorene	35	1.2E-01	422	5.1E+01	23	11	1	-	-	-	13
Other	Dibromochloromethane	38	2.1E-02	10,335	2.2E+02	28	8	1	1	-	-	13
PAH	Fluoranthene	42	1.2E-01	373	4.5E+01	29	13	-	-	-	-	13
Pesticide	BHC, alpha-	10	2.6E+02	30	7.9E+03	5	-	3	1	1	-	13
PAH	Acenaphthylene	31	1.2E-01	394	4.7E+01	20	10	1	-	-	-	12
Pesticide	Heptachlor epoxide	10	3.6E+02	2	6.3E+02	4	1	4	1	-	-	12
Pesticide	BHC, beta-	10	2.4E+02	2	4.5E+02	5	-	4	1	-	-	11
Other	Tetrachloroethane, 1,1,2,2-	14	3.0E-01	614	1.8E+02	7	5	1	1	-	-	10
Other	Nitrosodiphenylamine, N-	12	4.4E-01	2,329	1.0E+03	6	4	1	1	-	-	9
PAH	Acenaphthene	38	4.9E-02	793	3.9E+01	31	6	1	-	-	-	8
PAH	Benzo(ghi)perylene	12	8.0E-01	65	5.2E+01	6	4	2	-	-	-	8
Pesticide	Heptachlor	14	5.8E+00	56	3.2E+02	10	2	1	1	-	-	7
Pesticide	Endosulfan, alpha-	12	3.7E+01	3	9.7E+01	7	3	2	-	-	-	7
Other	Hexachloroethane	32	5.9E-02	377	2.2E+01	26	6	-	-	-	-	6
Pesticide	Endrin	20	9.3E-01	868	8.1E+02	16	3	-	1	-	-	6
Other	Dichloromethane	212	2.4E-04	175,765	4.2E+01	207	4	1	-	-	-	6
PAH	Naphthalene	122	1.4E-02	5,276	7.4E+01	118	3	1	-	-	-	5
Other	Chlorobenzene	55	2.0E-02	1,364	2.7E+01	50	5	-	-	-	-	5
Pesticide	Methoxychlor	1	5.8E+01	99	5.7E+03	-	-	-	-	1	-	4
Other	Tribromomethane	22	3.0E-02	4,611	1.4E+02	20	1	-	1	-	-	4
Pesticide	Diazinon \ Spectracide	1	9.7E+02	6	5.6E+03	-	-	-	-	1	-	4
Other	Phenol	158	1.1E-03	14,248	1.6E+01	155	3	-	-	-	-	3
Pesticide	Endosulfan mixed isomers	11	3.4E+00	5	1.7E+01	9	1	1	-	-	-	3

Table 4-2. (Continued)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Other	Dichlorobenzenes	5	8.9E-02	229	2.0E+01	3	1	1	-	-	-	3
Other	Di-n-butyl phthalate	77	5.5E-03	2,725	1.5E+01	75	2	-	-	-	-	2
Other	Dimethylphenol, 2,4-	36	2.0E-02	654	1.3E+01	34	2	-	-	-	-	2
Pesticide	BHC, delta-	9	9.2E+00	1	1.4E+01	8	-	1	-	-	-	2
Pesticide	Endosulfan, beta-	9	7.6E+00	2	1.3E+01	7	2	-	-	-	-	2
Other	Bromophenyl phenyl ether, 4-	11	7.8E-02	57	4.4E+00	10	1	-	-	-	-	1
Pesticide	DCPA/Dacthal	1	9.2E-03	286	2.6E+00	-	1	-	-	-	-	1
Other	Acetone	14	3.5E-06	4,813	1.7E-02	14	-	-	-	-	-	0
Other	Dichloroethane, 1,1-	63	1.7E-05	1,067	1.8E-02	63	-	-	-	-	-	0
Other	Trichlorofluoromethane	9	2.8E-05	7,086	2.0E-01	9	-	-	-	-	-	0
Other	Isophorone	15	2.0E-04	403	8.1E-02	15	-	-	-	-	-	0
Other	Methyl ethyl ketone	4	5.4E-07	29	1.6E-05	4	-	-	-	-	-	0
Other	Butyl benzyl phthalate	20	1.5E-03	316	4.7E-01	20	-	-	-	-	-	0
Other	Xylene, o-	13	1.5E-01	2	3.2E-01	13	-	-	-	-	-	0
Other	Cresol, o-	1	3.5E-03	0	1.7E-03	1	-	-	-	-	-	0
Other	Tetrachlorobenzene, 1,2,4,5-	1	4.5E-02	0	1.8E-03	1	-	-	-	-	-	0
Other	Ethylbenzene	200	2.8E-04	5,830	1.6E+00	200	-	-	-	-	-	0
Other	Xylene, p-	12	1.6E-01	3	5.4E-01	12	-	-	-	-	-	0
Other	Cresol, p-	1	6.5E-05	6	3.8E-04	1	-	-	-	-	-	0
Other	Xylene, m-	9	1.6E-01	1	9.9E-02	9	-	-	-	-	-	0
Other	Di-n-octyl phthalate	18	1.8E-02	184	3.3E+00	18	-	-	-	-	-	0
Other	Trichlorobenzene, 1,2,4-	41	4.2E-03	665	2.8E+00	41	-	-	-	-	-	0
Other	Dimethyl phthalate	31	1.7E-02	305	5.2E+00	31	-	-	-	-	-	0
Other	Dibenzofuran	1	7.3E-03	43	3.1E-01	1	-	-	-	-	-	0
Other	Dichloroethene, trans-1,2-	68	8.7E-06	680	5.9E-03	68	-	-	-	-	-	0
Other	Dichlorobenzene, 1,3-	34	1.9E-02	292	5.6E+00	34	-	-	-	-	-	0

Table 4-2. (Continued)

Chemical Class	Chemical	Number of Facilities	SHS	Annual Release (lb/yr)	Total HAZREL	Distribution of HAZREL Score by Facility						Total HAZREL Score
						0	1	2	3	4	5	
Pesticide	BHC, technical grade	2	4.8E+01	0	6.9E-01	2	-	-	-	-	-	0
Other	Pentachlorobenzene	1	1.6E-01	0	6.4E-03	1	-	-	-	-	-	0
Pesticide	Mirex \ Dechlorane	1	9.4E+01	0	3.7E-01	1	-	-	-	-	-	0
Pesticide	Chlorpyrifos \ Dursban	2	5.4E-02	10	5.5E-01	2	-	-	-	-	-	0

HAZREL for each analyzed record to a HAZREL score from zero to five representing the magnitude of the SHS * ACL product. This approach minimizes the impact of a small number of very large release records that account for the majority of HAZREL and appropriately focuses attention on chemicals with a large number of potentially significant releases. The results for the DDT metabolite DDE illustrate this point. The HAZREL is very large, yet appears to be caused by a single release record. Although not ignoring the potential local importance of this individual release, the total HAZREL score reflects the overall national significance of point source DDE discharge.

Aggregate raw loads and HAZREL scores for individual chemicals are grouped by chemical class to determine which types of chemicals cause the greatest potential sediment hazard. Chemical classes are assigned in the following manner:

Divalent Metal: This group comprises five metal species (cadmium, copper, nickel, lead, and zinc) that are typically associated with acid-volatile sulfide (AVS). These metals have sulfide solubilities smaller than that of iron sulfide, making them less bioavailable as long as the AVS molar concentration (reservoir of sulfide anions in anoxic sediment) exceeds the sum of the molar concentrations of the simultaneously extracted metals.

Mercury: Mercury also has a sulfide solubility less than that of iron sulfide; however, mercury was not included with the other AVS metals because of the complicating factors of methylation in sediment and subsequent bioaccumulation. Unfortunately, the sediment chemistry screening value does not account for the effects of this bioaccumulation potential.

Other Metal: This group includes the remaining metals evaluated: antimony, arsenic, chromium, and silver.

Pesticide: This group includes chemicals that are usually large, complex, and manufactured to be biological inhibitors.

Polynuclear Aromatic Hydrocarbon (PAH): This group includes all polynuclear aromatic hydrocarbons, including those which are halogenated.

Polychlorinated Biphenyl (PCB): This group includes all measured PCBs whether reported as total PCBs or as one of seven aroclors. PCBs are highly toxic, highly bioaccumulative, and highly persistent.

Other Organic: This group includes the remaining organic chemicals not classified as pesticides, PAHs, or PCBs.

Table 4-3 depicts raw loads, HAZREL, and HAZREL scores by chemical class for TRI data. The TRI data show that other organic and divalent metal categories represent about 95 and 4 percent of the annual release, respectively. These same categories represent 54 and 36 percent of the HAZREL score. Metals (antimony, arsenic, chromium, and silver) account for 6 percent of the HAZREL score while less than 1 percent of the annual release. All other chemical groups account for less than 3 percent of the total HAZREL score for TRI data. Table 4-4 depicts raw loads, HAZREL, and HAZREL scores by chemical class for PCS data. In contrast to the TRI data, divalent metals dominate the raw load and HAZREL

Table 4-3. Analysis of TRI Data by Chemical Class

Chemical Class	Annual Release (lb/yr)	HAZREL	Distribution of HAZREL Score[a]						HAZREL Score
			0	1	2	3	4	5	
Divalent Metal	268,723	1.0E+04	1,403	704	117	16	-	-	986
Mercury	271	1.9E+03	-	3	5	6	-	-	31
Metal	63,887	2.3E+03	560	114	22	4	-	-	170
Pesticide	47	1.5E+04	-	-	2	2	-	1	15
PAH	37,952	9.3E+02	87	37	13	2	-	-	69
PCB	66	1.9E+04	-	-	-	-	-	1	5
Other Organic	6,955,304	6.7E+04	2,785	554	332	74	15	-	1,500

[a]Facilities are counted more than once since facilities may report loadings for more than one chemical per chemical class.

Table 4-4. Analysis of PCS Data by Chemical Class

Chemical Class	Annual Release (lb/yr)	HAZREL	Distribution of HAZREL Score[a]						HAZREL Score
			0	1	2	3	4	5	
Divalent Metal	15,176,965	3.9E+05	5,611	2,896	1,368	329	68	2	6,901
Mercury	28,592	2.0E+05	269	233	172	62	9	4	819
Metal	1,821,078	8.0E+05	1,583	673	390	94	24	3	1,846
Pesticide	3,646	1.2E+06	103	32	54	33	11	7	318
PAH	36,419	4.6E+04	323	134	84	56	11	-	514
PCB	1,641	4.8E+05	27	32	36	38	14	4	294
Other Organic	1,920,606	4.7E+04	3,381	386	126	31	4	1	752

[a]Facilities are counted more than once since facilities may report loadings for more than one chemical per chemical class.

score for PCS. The PCS data show that the divalent metal, other organic, and other metal categories represent 80, 10, and 10 percent of the annual release, respectively. These same categories represent 60, 7, and 16 percent of the HAZREL score. Mercury also contributes 7 percent to the aggregate HAZREL score. Contributions to the HAZREL score from pesticides, PAHs, and PCBs range from 3 to 5 percent.

Analysis by Watershed

To evaluate watersheds, HAZREL scores are grouped by USGS hydrologic unit codes. The 8-digit hydrologic unit code is one of several ways to define a watershed, and it represents four levels of organization. The first two digits represent the region. USGS divides the contiguous United States into 18 distinct hydrologic regions based on river drainage. Alaska, Hawaii, and the Caribbean are regions 19, 20, and 21, respectively. Each region is divided into as many as 30 subregions, but typically regions contain approximately 10 subregions. Subregions are represented by the first 4 digits in the 8-digit code. Subregions can be further subdivided into as many as four accounting units, represented by the first 6 digits of the 8-digit code. Accounting units, in turn, can be subdivided into as many as 10 cataloging units, represented by the full 8-digit code. For the purposes of this study, HAZREL

scores are summed according to USGS cataloging units (8-digit code). There are more than 2,100 cataloging units (watersheds) in the United States.

Based on the data from TRI and PCS, a total HAZREL score was computed for 733 and 861 watersheds, respectively. For watersheds represented by both TRI and PCS the higher of the two scores was applied. This approach resulted in a total HAZREL score for 1,020 watersheds. Selecting the maximum HAZREL score, rather than adding the results, eliminates problems associated with double-counting releases; however, this approach may underestimate total releases and the "true" HAZREL score. Total HAZREL scores at the watershed level ranged from 0 to 312, although few were above 100. To divide individual watersheds into groups based on releases of sediment contaminants, EPA simply created quintiles within the 0 to 100 range. Watersheds with a total HAZREL score from 81 to 100 were assigned to priority group 1, or the first quintile. All watersheds with total HAZREL scores greater than 100 were also placed in the first quintile. Priority group 2 watersheds have a HAZREL score of 61 to 80. Priority group 3 watersheds have a HAZREL score of 41 to 60, and priority group 4 watersheds have a HAZREL score from 21 to 40. Priority group 5 watersheds have a HAZREL score from 1 to 20. Watersheds with no data or a HAZREL score of zero were not assigned to a priority group. Figure 4-1 presents the watersheds in the contiguous United States based on HAZREL score for priority groups 1 through 4.

Table 4-5 summarizes this information for each EPA region. The majority of priority group 1, 2, and 3 watersheds are in EPA Regions 2 and 5. Of the 1,020 watersheds evaluated, 17 watersheds were placed in priority group 1, 19 watersheds were placed in priority group 2, 29 watersheds were placed in priority group 3, 87 watersheds were placed in priority group 4, and 672 watersheds were placed in priority group 5. The remaining 196 watersheds had a HAZREL score of zero and were not assigned to a priority group. Appendix B contains a detailed table listing all of the 824 watersheds assigned to the 5 priority groups and includes information on the predominant chemical class and predominant industrial category associated with that chemical class. The following is a list of the 17 watersheds assigned to priority group 1:

Watershed Name	*State Location*
Narragansett	MA, RI
Lower Hudson	NY, CT, NJ
Hackensack-Passaic	NY, NJ
Sandy Hook-Staten Island	NY, NJ
Northern Long Island	NY
Southern Long Island	NY
Middle Delaware-Musconetcong	PA, NJ
Lower Delaware	PA, NJ
Schuylkill	PA
Delaware Bay	NJ
Detroit	MI
Niagara	NY
Seneca	NY
Upper Ohio	WV, PA, OH
Lower Mississippi-Baton Rouge	LA
Buffalo-San Jacinto	TX
San Francisco Bay	CA

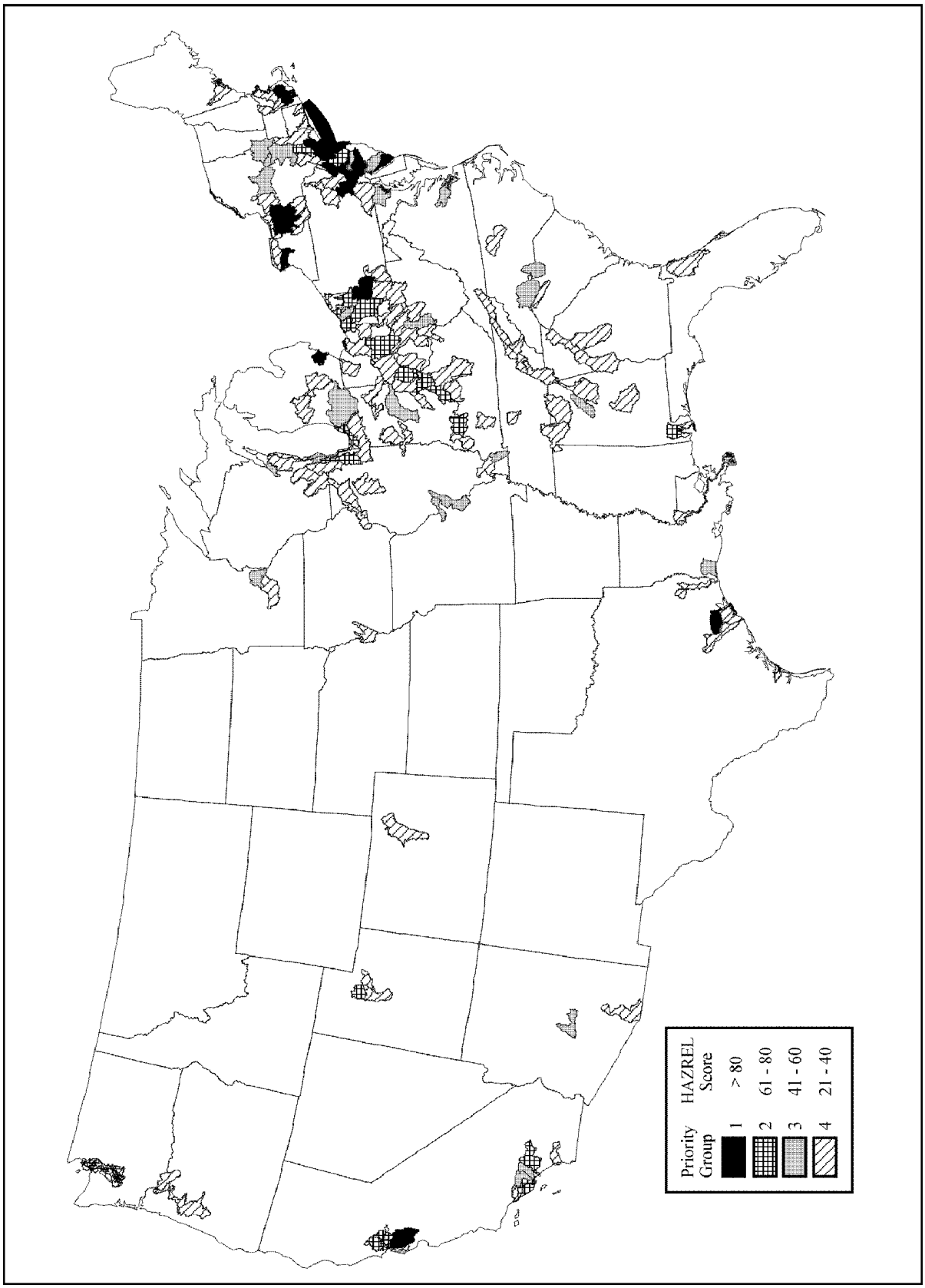


Figure 4-1. HAZREL score by watershed.

Table 4-5. Number of Watersheds in Each Priority Group by EPA Region[a,b]

Priority Group	EPA Region										Total Watersheds[c]
	1	2	3	4	5	6	7	8	9	10	
1	2	10	4	0	2	2	0	0	1	0	17
2	0	2	1	4	11	0	0	1	4	0	19
3	2	7	5	4	10	2	2	0	4	0	29
4	7	9	11	24	28	5	2	3	5	6	87
5	27	29	69	182	134	111	75	47	32	29	672
TOTAL	38	57	90	214	185	120	79	51	46	35	824

[a]Watersheds may be reported in more than one EPA Region.
[b]Watersheds with no reported data or a HAZREL Score equal to 0 are not reported.
[c]Total watersheds will not equal the sum of the Regional values because watersheds may be located in more than one EPA Region.

The general relationship between annual point source releases and results of the Site Inventory evaluation demonstrate a co-occurrence of active discharge of sediment contaminants and evidence of sediment contamination. Figure 4-2 depicts this relationship by plotting the percent of monitoring stations with a high (Tier 1) or intermediate (Tier 2) probability of contamination in a watershed, as ascribed in the Site Inventory, versus the watershed HAZREL score. Only those watersheds with at least one Tier 1 or Tier 2 station from the Site Inventory evaluation and a HAZREL score above zero are plotted. In watersheds with HAZREL scores greater than 50, at least 70 percent of all monitoring stations within the watershed exhibit some degree of contamination. Watersheds with relatively low HAZREL scores vary greatly in the extent of contamination, demonstrating the importance of contaminant sources not documented in this study, such as historical releases and nonpoint sources.

Watersheds with high HAZREL scores are more likely to contain areas of widespread potential sediment contamination (APCs) in the Site Inventory evaluation. In Figure 4-2, containing APC watersheds are plotted as dark circles, whereas all other watersheds are plotted as cross marks. Overall, approximately 10 percent of watersheds receiving point source discharges contain APCs. However, it is apparent that the fraction of watersheds containing APCs increases as the HAZREL score increases. In fact, watersheds containing APCs constitute 75 percent (12 of 16) of priority group 1 watersheds. Figure 4-3 further illustrates this relationship. For priority groups 2 and 3, 37 and 35 percent of the watersheds are APCs, respectively. For priority group 4, 21 percent of the watersheds contain APCs. For priority group 5, only 8 percent of the watersheds contain APCs. Less than 1 percent of the watersheds with a HAZREL score of zero contain APCs.

While this analysis does not imply that point sources caused the in-place contamination, it emphasizes the potential significance of contaminant releases in areas already contaminated. There are many sources of sediment contaminants in watersheds, both active and historical, point and nonpoint. This assessment identifies specific watersheds where active point sources might play an important role. To promote natural recovery of contaminated areas, active dischargers must be adequately controlled to ensure that their releases do not perpetuate contamination problems.

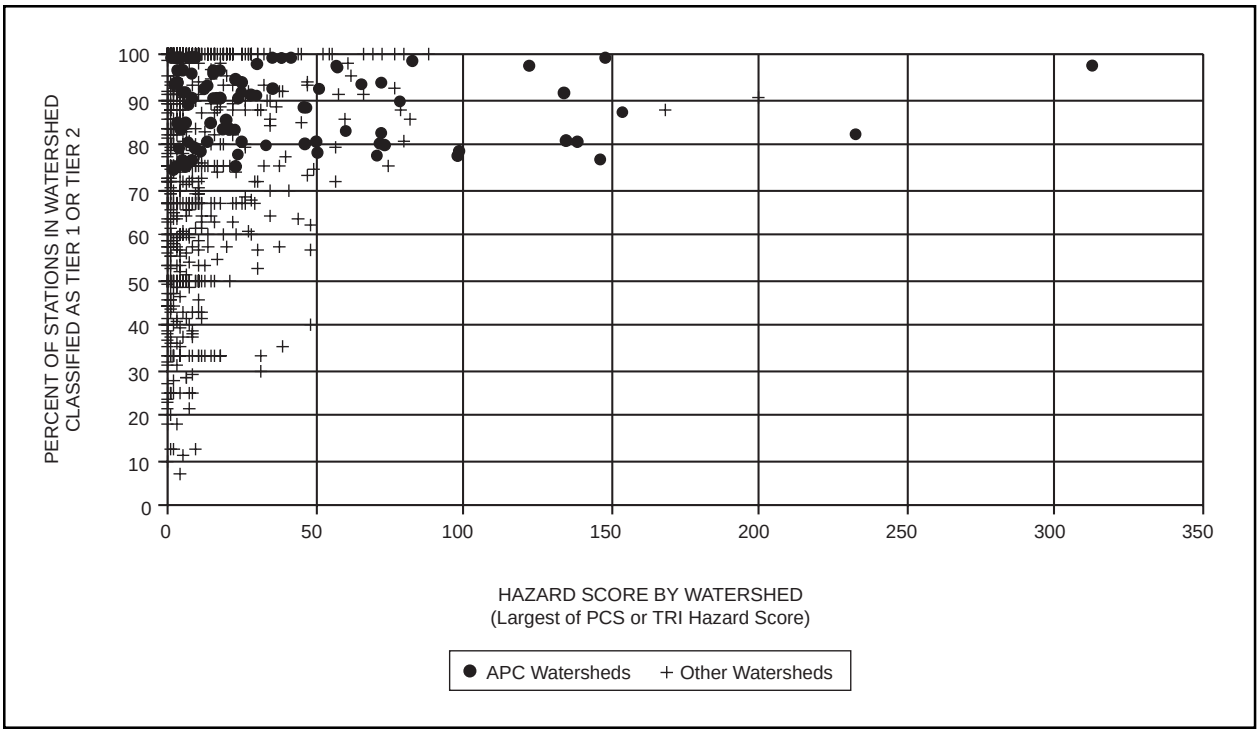
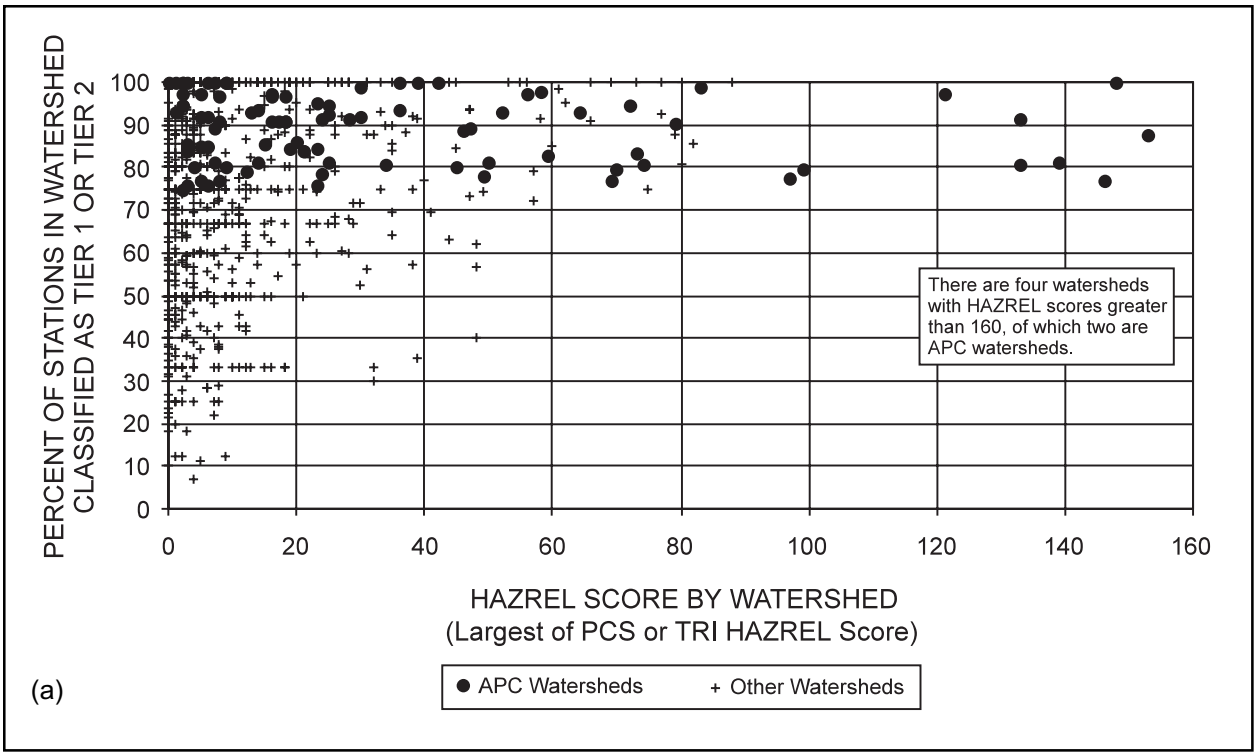


Figure 4-2. Comparison of Survey evaluation to HAZREL score by watershed: percent of stations classified as Tier 1 or 2 as a function of HAZREL score.

Analysis by Industrial Category

Facility-level HAZREL scores for chemical releases were summed by industrial categories, as assigned based on the primary SIC code reported in PCS or TRI. There are 31 industrial categories overall, covering a broad range of activities. Table 4-6 lists these industrial categories by descending HAZREL score for TRI data. Table 4-7 presents the same information for PCS data. For TRI data, metal products and finishing, primary metal industries, petroleum refining, and industrial organic chemicals account for 67 percent of the HAZREL score. For PCS data, sewerage systems (i.e., POTWs), other public utilities, metal products and finishing, and industrial organic chemicals account for 80 percent of the HAZREL score. POTWs alone account for 62 percent of the HAZREL score. For PCS, the dominant industrial categories are also the ones required to perform the most monitoring. Thus, these results reflect data availability as much as relative sediment hazard potential. Only five TRI facilities, but a significant number of PCS facilities (198), do not fall into the defined industrial categories or do not report a primary SIC code. These facilities are listed as "Nonclassifiable."

Tables C1 and C2 in Appendix C present HAZREL scores grouped by chemical for each industrial category for TRI and PCS, respectively. The number of facilities within the industrial category discharging each chemical, the raw load (lb/yr), and HAZREL are also presented. These tables are not comprehensive lists of all chemicals discharged from all facilities, but are limited to industrial category-chemical combinations where the HAZREL scores exceed 0. Tables 4-6 and 4-7 also present the number of facilities in each industrial category. Most of the PCS facilities (38 percent) included in the hazard analysis are POTWs,



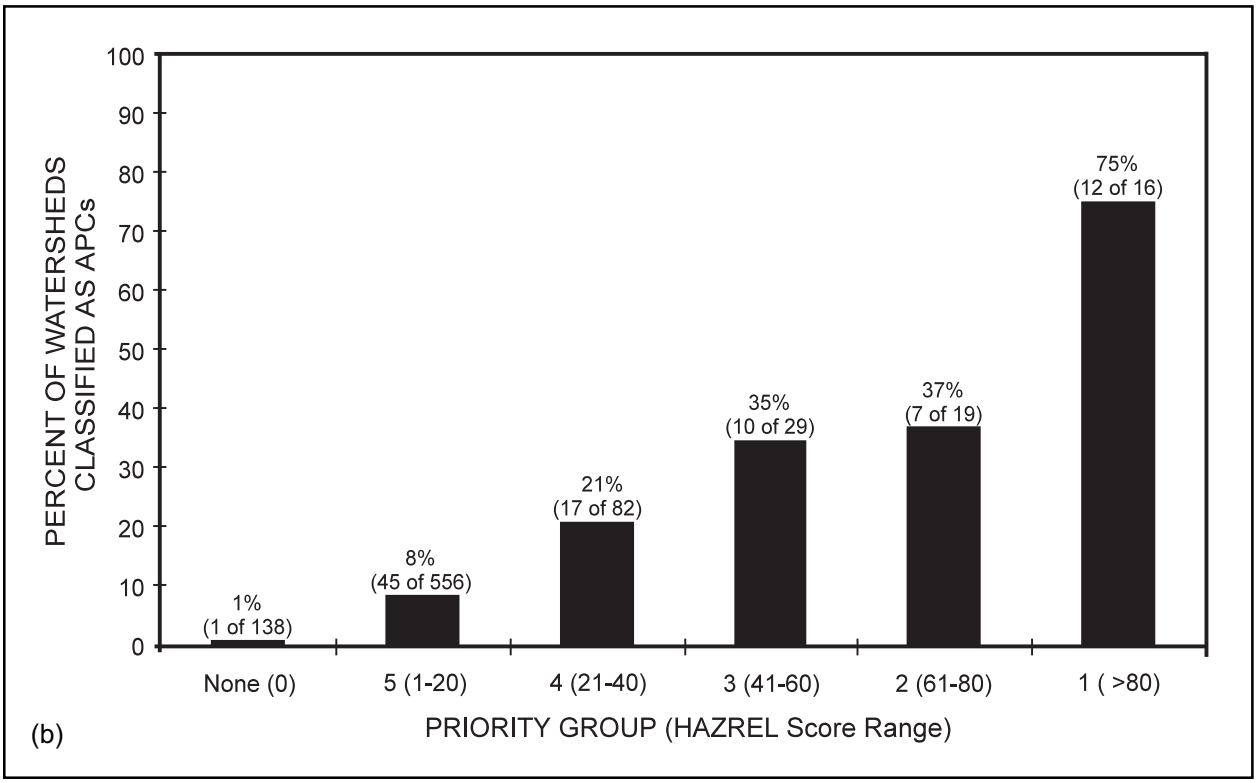


Figure 4-3. Comparison of Survey evaluation to HAZREL score by watershed: (a) percent of stations classified as Tier 1 or 2 as a function of HAZREL score, (b) percent of watersheds that are contain APCs by priority group.

Table 4-6. Analysis of TRI Data by Industrial Category Sorted by Descending HAZREL Score)

Industrial Category	Number of Facil.	Annual Release (lb/yr)	HAZREL	Distribution of HAZREL Score[a]						HAZRE-L Score
				0	1	2	3	4	5	
Metal Products and Finishing	1,501	508,725	1.3E+04	1,838	565	99	13	1	-	806
Primary Metal Industries	488	289,375	2.4E+04	608	269	56	10	-	1	416
Petroleum Refining	128	755,797	1.8E+04	333	127	92	16	8	-	391
Industrial Organic Chemicals	244	1,747,680	2.9E+04	454	90	50	13	2	1	242
Other Chemical Products	215	82,406	4.5E+03	386	63	34	4	1	-	147
Industrial Inorganic Chemicals	61	98,805	6.2E+03	85	25	34	14	-	-	135
Paper and Allied Products	170	1,515,980	1.1E+03	299	83	22	1	-	-	130
Plastic Materials and Synthetics	140	385,059	2.4E+03	232	35	31	4	-	-	109
Textile Products	70	272,467	7.1E+03	33	18	23	8	2	-	96
Pharmaceuticals	84	1,368,481	5.1E+03	139	31	13	8	1	-	85
Lumber and Wood Products	52	10,766	2.4E+03	63	23	8	8	-	-	63
Pesticides	24	7,466	9.6E+02	43	13	4	3	-	-	30
Rubber and Plastics Products	86	97,542	9.9E+02	99	20	3	1	-	-	29
Food and Kindred Products	21	23,427	2.4E+02	8	10	5	-	-	-	20
Furniture and Fixtures	20	10,452	1.6E+02	38	7	6	-	-	-	19
Stone, Clay, and Glass Prod.	44	21,619	2.4E+02	46	10	2	1	-	-	17
Leather and Leather Products	19	5,257	8.6E+01	14	6	3	-	-	-	12
Petroleum and Coal Products	13	119,502	7.1E+01	28	3	3	-	-	-	9
Printing and Publishing	37	3,323	3.2E+01	54	6	1	-	-	-	8
Nonclassifiable	5	1,150	3.6E+01	7	3	2	-	-	-	7
Other Trade and Services	9	922	2.3E+01	24	5	-	-	-	-	5
Tobacco Products	1	51	2.0E-01	4	-	-	-	-	-	0

[a]Facilities are counted more than once since facilities may report loadings for more than one chemical.

with other public utilities, other trade and services, metal products and finishing, and primary metal industries also well represented.

Most of the TRI facilities (44 percent) are metal products and finishing operations. Primary metal industries, industrial organic chemicals, and other chemical products represent another 14, 7, and 6 percent of the represented facilities, respectively. Some industrial categories are not well represented in either PCS or TRI. This limited representation could be a result of many facilities within the industry not qualifying for major NPDES permits (which require monthly discharge monitoring for specific chemicals), not meeting the reporting requirements for TRI, or not having release records for pollutants retained in the hazard analysis.

Table 4-7. Analysis of PCS Data by Industrial Category (Sorted by Descending HAZREL Score)

Industrial Category	Number of Facil.	Annual Release (lb/yr)	HAZREL	Distribution of HAZREL Score[a]						HAZRE-L Score
				0	1	2	3	4	5	
Sewerage Systems	1,854	9,633,326	2.4E+06	3,957	2,584	1,425	416	79	15	7,073
Public Utilities	542	2,323,268	1.3E+05	1,064	220	155	71	16	2	817
Metal Products and Finishing	443	1,703,481	3.4E+05	1,303	298	104	25	13	1	638
Industrial Organic Chemicals	140	1,533,573	6.6E+04	747	259	100	35	10	1	609
Primary Metal Industries	268	463,543	2.5E+04	545	215	94	30	5	-	513
Plastic Materials and Synthetics	108	258,689	1.1E+04	406	152	58	17	2	-	327
Industrial Inorganic Chemicals	101	341,325	1.7E+04	224	87	52	16	5	-	259
Other Trade and Services	479	99,958	9.6E+03	1,326	95	25	5	2	-	168
Petroleum Refining	132	648,506	8.5E+03	186	85	36	1	2	-	168
Metal Mining	65	310,246	4.7E+03	150	69	39	1	1	-	154
Paper and Allied Products	109	519,868	7.4E+03	124	67	32	4	1	-	147
National Security	32	138,848	6.2E+04	88	36	25	3	1	1	104
Nonclassifiable	198	50,066	1.2E+03	482	43	16	4	-	-	87
Other Chemical Products	57	33,154	1.6E+03	108	39	16	4	-	-	83
Textile Products	61	608,873	9.8E+03	84	35	6	3	2	-	64
Food and Kindred Products	51	40,327	5.7E+02	73	16	14	1	-	-	47
Rubber and Plastics Products	48	124,606	3.3E+04	100	11	6	3	1	1	41
Pharmaceuticals	36	104,286	7.9E+02	86	22	4	2	-	-	36
Pesticides	16	11,916	2.5E+02	22	9	7	-	-	-	23
Nonmetallic Mineral Mining	15	4,456	1.1E+03	23	10	3	1	-	-	19
Lumber and Wood Products	23	7,494	8.7E+02	38	7	2	1	-	-	14
Stone, Clay, and Glass Products	38	5,970	2.0E+02	67	7	3	-	-	-	13
Furniture and Fixtures	7	957	8.6E+01	22	5	2	-	-	-	9
Leather and Leather Products	10	5,678	8.0E+01	13	3	3	-	-	-	9
Printing and Publishing	5	840	8.4E+01	8	6	1	-	-	-	8
Coal Mining	5	603	5.3E+01	7	4	1	-	-	-	6
Petroleum and Coal Products	11	14,712	1.5E+03	16	-	1	-	1	-	6
Construction	3	104	5.7E+00	9	1	-	-	-	-	1
Oil and Gas Extraction	11	213	4.9E+00	17	1	-	-	-	-	1
Grain Production	1	62	7.6E-01	2	-	-	-	-	-	0

[a]Facilities are counted more than once since facilities may report loadings for more than one chemical.

Conclusions

EPA conducted the screening-level sediment hazard analysis of the Point Source Inventory data to obtain more information about potential sediment contamination and its sources, and to prioritize chemicals, watersheds, and industries for further evaluation. The inventory is limited by the quality, quantity, coverage, and bias of the release data in TRI

and PCS. The hazard analysis is limited by the lack of consideration of site-specific information, the lack of pollutant transport analysis, and the uncertainty associated with the components of the chemical-specific sediment hazard scores. For these reasons, the results of the hazard assessment should be used for screening purposes only, not as a definitive judgment regarding the most significant sediment contaminants, the most affected watersheds, or the most important industrial categories.

This study indicates that point source releases of sediment contaminants to surface water are ongoing and, in many cases, coincident with areas where there is evidence of contamination. TRI and PCS contain records of approximately 25,500 individual point source releases of 111 different sediment contaminants into over 1,000 watersheds across the country from 31 distinct industrial categories. Direct releases from 4,869 facilities in PCS totaled nearly 19 million pounds per year in 1994. Based on 1993 TRI data, direct releases and transfers to POTWs (multiplied by 0.25 to account for removal during treatment) from 3,432 manufacturing facilities totaled 7.3 million lb/yr. Assuming that there is some overlap between TRI and PCS, these databases together indicate that major municipal and industrial facilities release about 20-25 million pounds of sediment contaminants annually.

This analysis indicates that metals and organic chemicals other than pesticides, PAHs, and PCBs constitute the most widespread potential sediment hazard from point sources. Although important in some instances, releases of PAHs, pesticides, and PCBs appear to be less prevalent. Site Inventory evaluation results indicate that other organic chemicals, as a class of pollutants, are not as significant as other classes. The potential sediment hazard posed by metals represents the most substantial area of agreement between the Point Source Inventory hazard assessment and the Site Inventory evaluation, on both an individual chemical basis and a watershed basis. The Point Source Inventory and Site Inventory both rely on correlative, statistically based threshold values to evaluate the potential adverse effects of metals in sediment. Although these correlative thresholds are useful, they are limited in their application because they do not directly address the bioavailability of metals in sediment. This report further emphasizes the need for the development of practical assessment tools to evaluate the bioavailability and toxicity of metals in sediment.

The watersheds identified in this analysis represent areas where sediment contaminants are discharged; they do not necessarily represent locations where sediment contamination has occurred or will occur. Watersheds, as defined by the USGS 8-digit cataloging unit, can represent large areas encompassing large mainstem rivers and small tributary streams that vary greatly in size, shape, and physical/chemical characteristics. Transport, sediment partitioning, and sediment accumulation—whether in locations very close to the point of discharge or far downstream—depend on many factors, including streamflow, stream velocity, geomorphology, particle size distribution, organic carbon content, suspended sediment load, temperature, pH, and salinity. However, comparison with existing sediment monitoring data provides further means of screening watersheds where point sources are more likely to contribute to contamination.

A watershed with a high HAZREL score is more likely contain one of the 96 areas of potential widespread sediment contamination (APCs) in the Site Inventory evaluation. The EPA report *Environmental Goals for America With Milestones for 2005* (USEPA, 1996a) proposes that the Agency, together with its state partners, adequately control point sources

of contamination over the next 10 years in 10 percent of the watersheds where sediment contamination is widespread. Specifically, major facility discharge limits need to be evaluated and appropriately revised in watersheds at greatest risk from active discharges. The objective of these evaluations should be to determine whether existing technology-based controls or water quality-based discharge limits protect downstream sediment quality to the degree necessary for natural recovery of contaminated sites. EPA is currently developing the methodology to relate point source contributions to sediment contaminant concentrations. This methodology is needed before developing permit limits protective of sediment quality. This report identifies 29 watersheds that both contain APCs from the Site Inventory and are in HAZREL priority group 1, 2, or 3 from this analysis. These watersheds should be considered for further evaluation and necessary action to achieve the milestone in EPA's Goals Report.